

PCT  
PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C. 20231  
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

<b>Date of mailing (day/month/year)</b> 23 August 1999 (23.08.99)	
<b>International application No.</b> PCT/GB99/00153	<b>Applicant's or agent's file reference</b> DAV/P94109WO
<b>International filing date (day/month/year)</b> 18 January 1999 (18.01.99)	<b>Priority date (day/month/year)</b> 17 January 1998 (17.01.98)
<b>Applicant</b> APPLETON, Ernest et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

06 August 1999 (06.08.99)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election
- ☒
- was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer Marc Salzman</p> <p>Telephone No.: (41-22) 338.83.38</p>
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## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>DAV/P94109W0</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 99/ 00153</b>	International filing date (day/month/year) <b>18/01/1999</b>	(Earliest) Priority Date (day/month/year) <b>17/01/1998</b>
Applicant <b>UNIVERSITY OF DURHAM et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

3

☐ None of the figures.



# INTERNATIONAL SEARCH REPORT

National Application No.

T/GB 99/00153

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 F16L55/28

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 98 06927 A (ASTEC DEV LTD ;SIMPSON NEIL ANDREW ABERCROMBI (GB)) 19 February 1998 see page 14, line 19 - page 16, line 25; figures 5-7	1-3,16, 17
A	GB 2 305 407 A (UNIV DURHAM) 9 April 1997 cited in the application see page 3, line 21 - page 7, line 14; figures	1-5,14, 15
A	US 5 121 694 A (ZOLLINGER WILLIAM T) 16 June 1992	
A	US 5 625 917 A (HAWKINS RONALD E) 6 May 1997	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

16 April 1999

Date of mailing of the international search report

03/05/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Christensen, J



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/00153

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 9806927	A	19-02-1998	AU	3948897 A	06-03-1998
GB 2305407	A	09-04-1997	AU	700878 B	14-01-1999
			AU	6994196 A	09-04-1997
			CA	2232618 A	27-03-1997
			EP	0851988 A	08-07-1998
			WO	9711307 A	27-03-1997
US 5121694	A	16-06-1992	NONE		
US 5625917	A	06-05-1997	NONE		





## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference RMV/P94109WO	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB99/00153	International filing date (day/month/year) 18/01/1999	Priority date (day/month/year) 17/01/1998
International Patent Classification (IPC) or national classification and IPC F16L55/28		
Applicant UNIVERSITY OF DURHAM et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☒ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 06/08/1999	Date of completion of this report 03.11.99
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Durrenberger, X Telephone No. +49 89 2399 2755 



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB99/00153

**I. Basis of the report**

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

**Description, pages:**

1-12 as originally filed

**Claims, No.:**

1-23 as originally filed

**Drawings, sheets:**

1/3-3/3 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**II. Priority**

1. ☐ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:

☐ copy of the earlier application whose priority has been claimed.

☐ translation of the earlier application whose priority has been claimed.

2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid.



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB99/00153

Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

**see separate sheet**

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes:	Claims	1-23
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-23
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-23
	No:	Claims	

2. Citations and explanations

**see separate sheet**



1

1

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB99/00153

**Re Item II Priority**

The priority right has been examined referring to document 9800905.5 filed on 17-01-1998 in the United Kingdom.

It appears that the following claims and paragraphs of the description of the present application could not be found in the priority document or their subject-matter was not implicitly disclosed in this document:

- claim 4,
- claim 10,
  
- page 3, third paragraph of the description,
- page 5, third paragraph of the description,
- page 12, the three paragraphs in the description and the corresponding figures 5 and 6.

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The subject-matter of claim 1 relates to a surface traversing vehicle moved by the relative movement of two bodies which comprise resilient bristles fixed on displaceable bristle-carrying members.

None of the available documents of the prior art discloses such a construction, the subject-matter of claim 1 is therefore new.

The closest prior art is the cited document GB-A-2 305 407 which discloses a surface traversing vehicle according to the preamble of claim 1, the present application is distinguished therefrom by the features of the characterising portion:

- the bristles are mounted on bristle-carrying members each guided for movement towards and away from the body,
- the movement of these bristle-carrying members is done by fluid pressure means.





**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB99/00153

The technical effect thereby achieved is to facilitate the change of orientation of the bristles in order to reverse the direction of progression of the vehicle.

The principle of retracting the bristle is mentioned in the above-cited document, which does not disclose a way of realising such a movement of the bristle, and no other document of the available prior art gives a hint upon achieving these technical effects.

The subject-matter of claim 1 appears therefore to involve an inventive step.

Claim 1 of the present application meets the criteria of article 33(2) and 33(3) of the PCT.

Dependent claims add further constructional features or precisions to the subject-matter of claim 1 and relate also to new and inventive subject-matter.

The subject-matter of all the claims is susceptible of industrial application.

Remark: The document WO 98 06927 A published after the priority date has been left out of consideration for examining novelty and inventive step of the claims of which the priority has been considered as valid.



# PATENT COOPERATION TREATY

PTO/PCT Rec'd 10 JUL 2000

## PCT

From the INTERNATIONAL SEARCHING AUTHORITY

To:

URQUHART-DYKES & LORD  
Attn. VIRR, D.  
St. Nicholas Chambers  
Amen Corner  
Newcastle-Upon-Tyne NE1 1PE  
UNITED KINGDOM

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL SEARCH REPORT  
OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference <b>DAV/P94109W0</b>		Date of mailing (day/month/year) <b>03/05/1999</b>
International application No. <b>PCT/GB 99/ 00153</b>	International filing date (day/month/year) <b>18/01/1999</b>	
Applicant <b>UNIVERSITY OF DURHAM et al.</b>		

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

**Filing of amendments and statement under Article 19:**

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

**When?** The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

**Where?** Directly to the International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland  
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority

 European Patent Office, P.B. 5818 Patentlaan 2  
NL-2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.  
Fax: (+31-70) 340-3016

Authorized officer

Germaine Moet



## NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

### INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

#### What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

#### When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

#### Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

#### How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

#### What documents must/may accompany the amendments?

##### Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.



## NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:  
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:  
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:  
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or  
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:  
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

### "Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

**It must be in the language in which the international application is to be published.**

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

### Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

### Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.





# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>DAV/P94109W0</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 99/ 00153</b>	International filing date (day/month/year) <b>18/01/1999</b>	(Earliest) Priority Date (day/month/year) <b>17/01/1998</b>
Applicant <b>UNIVERSITY OF DURHAM et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

### 1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (see Box II).

### 4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

### 5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

3

☐ None of the figures.



## INTERNATIONAL SEARCH REPORT

International Application No.

PC 97 GB 99/00153

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 F16L55/28

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	WO 98 06927 A (ASTEC DEV LTD ; SIMPSON NEIL ANDREW ABERCROMBI (GB)) 19 February 1998 see page 14, line 19 - page 16, line 25; figures 5-7	1-3, 16, 17
A	GB 2 305 407 A (UNIV DURHAM) 9 April 1997 cited in the application see page 3, line 21 - page 7, line 14; figures	1-5, 14, 15
A	US 5 121 694 A (ZOLLINGER WILLIAM T) 16 June 1992	
A	US 5 625 917 A (HAWKINS RONALD E) 6 May 1997	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

## \* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

16 April 1999

Date of mailing of the international search report

03/05/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Christensen, J



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/00153

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 9806927	A	19-02-1998	AU	3948897 A	06-03-1998
-----					
GB 2305407	A	09-04-1997	AU	700878 B	14-01-1999
			AU	6994196 A	09-04-1997
			CA	2232618 A	27-03-1997
			EP	0851988 A	08-07-1998
			WO	9711307 A	27-03-1997
-----					
US 5121694	A	16-06-1992	NONE		
-----					
US 5625917	A	06-05-1997	NONE		
-----					



17/7/2000

Initials

LM

From the

INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

URQUHART-DYKES &amp; LORD

To:

VINSOME, REX MARTIN  
URQUHART-DYKES & LORD  
St. Nicholas Chambers  
Amen Corner  
Newcastle-Upon-Tyne NE1 1PE  
GRANDE BRETAGNE

05 NOV 1999

NEWCASTLE

PCT

NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

(PCT Rule 71.1)

10 JUL 2000

Date of mailing  
(day/month/year)

03.11.99

Applicant's or agent's file reference  
RMV/P94109WO

## IMPORTANT NOTIFICATION

International application No.  
PCT/GB99/00153

International filing date (day/month/year)  
18/01/1999

Priority date (day/month/year)  
17/01/1998

Applicant

UNIVERSITY OF DURHAM et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

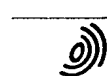
## 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office  
D-80298 Munich  
Tel. +49 89 2399 - 0 Tx: 523656 epmu d  
Fax: +49 89 2399 - 4465

Authorized officer

Rinder, K

Tel. +49 89 2399-2664







# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>RMV/P94109WO</b>	<b>FOR FURTHER ACTION</b>		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. <b>PCT/GB99/00153</b>	International filing date (day/month/year) <b>18/01/1999</b>	Priority date (day/month/year) <b>17/01/1998</b>	
International Patent Classification (IPC) or national classification and IPC <b>F16L55/28</b>			
Applicant <b>UNIVERSITY OF DURHAM et al.</b>			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☒ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  <b>06/08/1999</b>	Date of completion of this report  <div style="text-align: center; font-size: 1.2em;"><b>03.11.99</b></div>
Name and mailing address of the international preliminary examining authority:  <div style="display: flex; align-items: center;"> <div>             European Patent Office              D-80298 Munich              Tel. +49 89 2399 - 0 Tx: 523656 epmu d              Fax: +49 89 2399 - 4465           </div> </div>	Authorized officer  <b>Durrenberger, X</b>  Telephone No. +49 89 2399 2755





**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB99/00153

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

**Description, pages:**

1-12 as originally filed

**Claims, No.:**

1-23 as originally filed

**Drawings, sheets:**

1/3-3/3 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70:2(c)):

4. Additional observations, if necessary:

**II. Priority**

1. ☐ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:

- ☐ copy of the earlier application whose priority has been claimed.  
☐ translation of the earlier application whose priority has been claimed.

2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid.



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB99/00153

Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

**3. Additional observations, if necessary:**

**see separate sheet**

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims	1-23
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-23
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-23
	No:	Claims	

**2. Citations and explanations**

**see separate sheet**



**Re Item II Priority**

The priority right has been examined referring to document 9800905.5 filed on 17-01-1998 in the United Kingdom.

It appears that the following claims and paragraphs of the description of the present application could not be found in the priority document or their subject-matter was not implicitly disclosed in this document:

- claim 4,
- claim 10,
  
- page 3, third paragraph of the description,
- page 5, third paragraph of the description,
- page 12, the three paragraphs in the description and the corresponding figures 5 and 6.

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

The subject-matter of claim 1 relates to a surface traversing vehicle moved by the relative movement of two bodies which comprise resilient bristles fixed on displaceable bristle-carrying members.

None of the available documents of the prior art discloses such a construction, the subject-matter of claim 1 is therefore new.

The closest prior art is the cited document GB-A-2 305 407 which discloses a surface traversing vehicle according to the preamble of claim 1, the present application is distinguished therefrom by the features of the characterising portion:

- the bristles are mounted on bristle-carrying members each guided for movement towards and away from the body,
- the movement of these bristle-carrying members is done by fluid pressure means.









**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB99/00153

The technical effect thereby achieved is to facilitate the change of orientation of the bristles in order to reverse the direction of progression of the vehicle.

The principle of retracting the bristle is mentioned in the above-cited document, which does not disclose a way of realising such a movement of the bristle, and no other document of the available prior art gives a hint upon achieving these technical effects.

The subject-matter of claim 1 appears therefore to involve an inventive step.

Claim 1 of the present application meets the criteria of article 33(2) and 33(3) of the PCT.

Dependent claims add further constructional features or precisions to the subject-matter of claim 1 and relate also to new and inventive subject-matter.

The subject-matter of all the claims is susceptible of industrial application.

Remark: The document WO 98 06927 A published after the priority date has been left out of consideration for examining novelty and inventive step of the claims of which the priority has been considered as valid.



PCT  
PTO/PCT Rec'd 1

JUL 2000

For receiving Office use only

## REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference  
(if desired) (12 characters maximum) DAV/P94109WO

Box No. I TITLE OF INVENTION

Surface-Traversing Vehicle

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

University of Durham  
Old Shire Hall  
Old Elvet  
Durham DH1 3HP  
United Kingdom

☐ This person is also inventor.

Telephone No.

0191-3743930

Facsimile No.

0191-3747316

Teleprinter No.

State (that is, country) of nationality:

United Kingdom

State (that is, country) of residence:

United Kingdom

This person is applicant  
for the purposes of:☐all designated  
States☒all designated States except  
the United States of America☐the United States  
of America only☐the States indicated in  
the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Appleton, Ernest  
9 Dunelm Court  
South Street  
Durham DH1 4QX, United Kingdom

This person is:

☐ applicant only☒ applicant and inventor☐ inventor only (If this check-box  
is marked, do not fill in below.)

State (that is, country) of nationality:

United Kingdom

State (that is, country) of residence:

United Kingdom

This person is applicant  
for the purposes of:☐all designated  
States☐all designated States except  
the United States of America☒the United States  
of America only☐the States indicated in  
the Supplemental Box☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒

agent

☐

common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

Virr, Dennis Austin  
Urquhart-Dykes & Lord  
St Nicholas Chambers  
Amen Corner  
Newcastle upon Tyne NE1 1PE  
United Kingdom

Telephone No.

0191-2618573

Facsimile No.

0191-2221604

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.



Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Stutchbury, Neil William  
8 Glencourse  
East Boldon  
Tyne & Wear NE36 OLW  
United Kingdom

This person is:

- ☐ applicant only  
☒ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
United Kingdom

State (that is, country) of residence:  
United Kingdom

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.



Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☒ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> AL Albania                               | <input checked="" type="checkbox"/> LS Lesotho                                   |
| <input checked="" type="checkbox"/> AM Armenia                               | <input checked="" type="checkbox"/> LT Lithuania                                 |
| <input checked="" type="checkbox"/> AT Austria                               | <input checked="" type="checkbox"/> LU Luxembourg                                |
| <input checked="" type="checkbox"/> AU Australia                             | <input checked="" type="checkbox"/> LV Latvia                                    |
| <input checked="" type="checkbox"/> AZ Azerbaijan                            | <input checked="" type="checkbox"/> MD Republic of Moldova                       |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina                | <input checked="" type="checkbox"/> MG Madagascar                                |
| <input checked="" type="checkbox"/> BB Barbados                              | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BG Bulgaria                              | <input checked="" type="checkbox"/> MN Mongolia                                  |
| <input checked="" type="checkbox"/> BR Brazil                                | <input checked="" type="checkbox"/> MW Malawi                                    |
| <input checked="" type="checkbox"/> BY Belarus                               | <input checked="" type="checkbox"/> MX Mexico                                    |
| <input checked="" type="checkbox"/> CA Canada                                | <input checked="" type="checkbox"/> NO Norway                                    |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein  | <input checked="" type="checkbox"/> NZ New Zealand                               |
| <input checked="" type="checkbox"/> CN China                                 | <input checked="" type="checkbox"/> PL Poland                                    |
| <input checked="" type="checkbox"/> CU Cuba                                  | <input checked="" type="checkbox"/> PT Portugal                                  |
| <input checked="" type="checkbox"/> CZ Czech Republic                        | <input checked="" type="checkbox"/> RO Romania                                   |
| <input checked="" type="checkbox"/> DE Germany                               | <input checked="" type="checkbox"/> RU Russian Federation                        |
| <input checked="" type="checkbox"/> DK Denmark                               | <input checked="" type="checkbox"/> SD Sudan                                     |
| <input checked="" type="checkbox"/> EE Estonia                               | <input checked="" type="checkbox"/> SE Sweden                                    |
| <input checked="" type="checkbox"/> ES Spain                                 | <input checked="" type="checkbox"/> SG Singapore                                 |
| <input checked="" type="checkbox"/> FI Finland                               | <input checked="" type="checkbox"/> SI Slovenia                                  |
| <input checked="" type="checkbox"/> GB United Kingdom                        | <input checked="" type="checkbox"/> SK Slovakia                                  |
| <input checked="" type="checkbox"/> GD Grenada                               | <input checked="" type="checkbox"/> SL Sierra Leone                              |
| <input checked="" type="checkbox"/> GE Georgia                               | <input checked="" type="checkbox"/> TJ Tajikistan                                |
| <input checked="" type="checkbox"/> GH Ghana                                 | <input checked="" type="checkbox"/> TM Turkmenistan                              |
| <input checked="" type="checkbox"/> GM Gambia                                | <input checked="" type="checkbox"/> TR Turkey                                    |
| <input checked="" type="checkbox"/> HR Croatia                               | <input checked="" type="checkbox"/> TT Trinidad and Tobago                       |
| <input checked="" type="checkbox"/> HU Hungary                               | <input checked="" type="checkbox"/> UA Ukraine                                   |
| <input checked="" type="checkbox"/> ID Indonesia                             | <input checked="" type="checkbox"/> UG Uganda                                    |
| <input checked="" type="checkbox"/> IL Israel                                | <input checked="" type="checkbox"/> US United States of America                  |
| <input checked="" type="checkbox"/> IN India                                 | <input checked="" type="checkbox"/> UZ Uzbekistan                                |
| <input checked="" type="checkbox"/> IS Iceland                               | <input checked="" type="checkbox"/> VN Viet Nam                                  |
| <input checked="" type="checkbox"/> JP Japan                                 | <input checked="" type="checkbox"/> YU Yugoslavia                                |
| <input checked="" type="checkbox"/> KE Kenya                                 | <input checked="" type="checkbox"/> ZW Zimbabwe                                  |
| <input checked="" type="checkbox"/> KG Kyrgyzstan                            |  |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea |  |
| <input checked="" type="checkbox"/> KR Republic of Korea                     |  |
| <input checked="" type="checkbox"/> KZ Kazakhstan                            |  |
| <input checked="" type="checkbox"/> LC Saint Lucia                           |  |
| <input checked="" type="checkbox"/> LK Sri Lanka                             |  |
| <input checked="" type="checkbox"/> LR Liberia                               |  |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☒ All additional states
- ☐
- ☐

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)





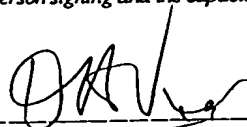
<b>Box No. VI PRIORITY CLAIM</b>		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 17/1/98	9800905.3	United Kingdom		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): ( 1 )

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

<b>Box No. VII INTERNATIONAL SEARCHING AUTHORITY</b>			
<b>Choice of International Searching Authority (ISA)</b> (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):  ISA / EP	<b>Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):</b>  Date (day/month/year)          Number          Country (or regional Office)		

<b>Box No. VIII CHECK LIST; LANGUAGE OF FILING</b>	
This international application contains the following number of sheets: request : 4 description (excluding sequence listing part) : 12 claims : 4 abstract : 1 drawings : 3 sequence listing part of description : Total number of sheets : 24	This international application is accompanied by the item(s) marked below: 1. <input checked="" type="checkbox"/> fee calculation sheet 2. <input type="checkbox"/> separate signed power of attorney 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: 4. <input type="checkbox"/> statement explaining lack of signature 5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): 6. <input type="checkbox"/> translation of international application into (language): 7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material 8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form 9. <input type="checkbox"/> other (specify):
Figure of the drawings which should accompany the abstract: 3	Language of filing of the international application: English

<b>Box No. IX SIGNATURE OF APPLICANT OR AGENT</b>	
Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).  <div style="text-align: center;">   <hr style="width: 200px; margin: 0 auto;"/> <p>Virr, Dennis Austin Agent for the Applicants</p> </div>	

For receiving Office use only	
1. Date of actual receipt of the purported international application:  3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:  4. Date of timely receipt of the required corrections under PCT Article 11(2):  5. International Searching Authority (if two or more are competent): ISA /	2. Drawings:  <input type="checkbox"/> received:  <input type="checkbox"/> not received:  6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.

For International Bureau use only	
Date of receipt of the record copy by the International Bureau:	

See Notes to the request form



# PCT

## FEE CALCULATION SHEET Annex to the Request

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant's or agent's  
file reference

DAV/P94109WO

Applicant

UNIVERSITY OF DURHAM

### CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE . . . . . £55.00 T

2. SEARCH FEE . . . . . £812.00 S

International search to be carried out by \_\_\_\_\_  
(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

### 3. INTERNATIONAL FEE

#### Basic Fee

The international application contains \_\_\_\_\_ sheets.

first 30 sheets . . . . . £285.00 b1

\_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ b2

remaining sheets . . . . . additional amount

Add amounts entered at b1 and b2 and enter total at B . . . . . £285.00 B

#### Designation Fees

The international application contains \_\_\_\_\_ designations.

10 x £65.00 = £650.00 D

number of designation fees payable (maximum 11) amount of designation fee

Add amounts entered at B and D and enter total at I . . . . . £935.00 I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT (if applicable) . . . . . £22.00 P

5. TOTAL FEES PAYABLE . . . . . £1824.00

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

TOTAL

☐ The designation fees are not paid at this time.

### MODE OF PAYMENT

☐ authorization to charge  
deposit account (see below)

☐ bank draft

☐ coupons

☒ cheque

☐ cash

☐ other (specify):

☐ postal money order

☐ revenue stamps

### DEPOSIT ACCOUNT AUTHORIZATION (this mode of payment may not be available at all receiving Offices)

The RO/ \_\_\_\_\_ ☐ is hereby authorized to charge the total fees indicated above to my deposit account.

☐ is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

☐ is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account.

Deposit Account No.

Date (day/month/year)

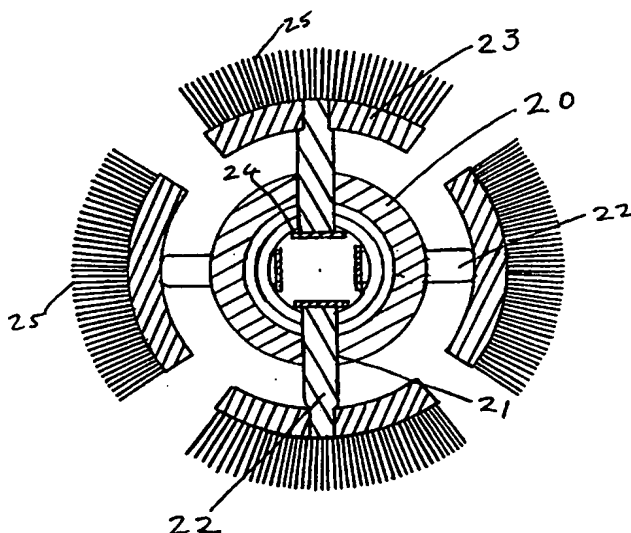
Signature





## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup> :</b>  <b>F16L 55/28</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 99/36724</b>  <b>(43) International Publication Date:</b> 22 July 1999 (22.07.99)
<b>(21) International Application Number:</b> PCT/GB99/00153  <b>(22) International Filing Date:</b> 18 January 1999 (18.01.99)  <b>(30) Priority Data:</b> 9800905.3      17 January 1998 (17.01.98)      GB  <b>(71) Applicant (for all designated States except US):</b> UNIVERSITY OF DURHAM [GB/GB]; Old Shire Hall, Old Elvet, Durham DH1 3HP (GB).  <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> APPLETON, Ernest [GB/GB]; 9 Dunelm Court, South Street, Durham DH1 4QX (GB). STUTCHBURY, Neil, William [GB/GB]; 8 Glencourse, East Boldon, Tyne & Wear NE36 0LW (GB).  <b>(74) Agent:</b> VIRR, Dennis, Austin; Urquhart-Dykes & Lord, St. Nicholas Chambers, Amen Corner, Newcastle upon Tyne NE1 1PE (GB).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>

**(54) Title:** SURFACE-TRAVERSING VEHICLE**(57) Abstract**

A vehicle for traversing a surface such as for carrying out an inspection, survey or maintenance operation upon that surface comprises two bodies interconnected by means to move the bodies towards and away from each other, each of those bodies being supported upon a multiplicity of resilient bristles (13; 25; 32) extending from it, the bristles of each body being mounted in groups upon bristle-carrying members (10; 23; 31) each guided for movement towards and away from the body, and fluid pressure means (25; 22; 34) to effect the guided movement of the bristle-carrying members in at least one of those directions.



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### Surface-Traversing Vehicle

The present invention is a vehicle for traversing a surface such as for carrying out an inspection, survey or maintenance operation upon that surface.

In Patent Specification No.GB2305407A we have described a vehicle for this purpose which comprises two bodies interconnected by means to move the bodies towards and away from each other, each said body being supported upon a multiplicity of resilient bristles extending from it. Operation of that vehicle by alternate moving of the bodies towards and away from each other causes it to move in successive steps along a generally linear path over the surface upon which it is supported. The bristles are inclined by a small amount away from being perpendicular to the surface and thereby provide a grip upon that surface which is greater in one direction than in the opposite direction, as determined by the direction of inclination of the bristles.

This foregoing surface-traversing vehicle has proved to be able to move progressively and effectively over a range of different surfaces. When it is required to move in the opposite direction, for example to withdraw from a tubular conduit in which it has been operating, it is necessary for the surface-gripping effect of the bristles to be reversed by reversing the direction of inclination of the bristles. One possible way of achieving that reversal is to rely wholly upon the resiliency of the bristles and to reverse their direction of inclination simply by pulling axially upon the relevant bristle-supporting



body. The reorientation of the bristles may be assisted by rotating the relevant body about its axis.

As indicated in the above patent specification, it could be advantageous if at least one of the bristle-supported bodies were constructed with retractable bristles. However the provision of a mechanically-operated system for retracting such bristles is particularly difficult in the case of surface-traversing vehicles of the present general type in that one important use of such vehicles is in the harsh environments of sewers, oil pipelines and the like, wherein deposited dirt and other sediments can readily impede continued satisfactory mechanical operations. It is perhaps not surprising that no satisfactory provision of such retractable bristles has hitherto been available.

It is therefore an object of the present invention to provide a surface-traversing vehicle of this general type in which a practical and advantageous retraction of the bristles is made possible.

The surface-traversing vehicle according to the present invention comprises two bodies interconnected by means to move the bodies towards and away from each other, each said body being supported upon a multiplicity of resilient bristles extending from it, the bristles of each said body being mounted in groups upon a plurality of bristle-carrying members each guided for movement towards and away from the said body, and fluid pressure means to effect said guided movement of said bristle-carrying members in at least one of said directions.

Thus, by operation of the fluid pressure means associated with one of the bodies, the bristles of that body may be retracted and/or extended as required, to enable their orientation to be



reversed and the body to be moved more readily in its reverse direction, thereby permitting reversal of the direction of movement of the surface-traversing vehicle.

As described in Specification No. GB2305407A, the interconnected bodies which are a feature of the surface-traversing vehicles of the type to which the present invention is applied may be of various shapes depending upon the general nature of the surface to be traversed. Thus they may be generally flat or, for example, rotationally symmetrical, for example generally cylindrical. The bristles may extend generally perpendicularly from the bodies if the bodies are flat. Most usually, the bodies will be generally cylindrical and the bristles will extend generally radially outwardly or inwardly of the body. While the surface-traversing vehicle may comprise generally hollow bodies with inwardly-directed bristles, designed to enable it to progress over the outer surface of a chimney, cable or like conduit, the vehicle is particularly well adapted to use within a tubular pipe, sewer or similar conduit and for that purpose will have outwardly-directed bristles, in particular bristles directed radially outwardly.

Although in most cases the bristles are preferably directed generally perpendicularly, including radially, from the bodies upon which they are mounted, in particular when the bodies are viewed from the side relative to their direction of relative movement, when those bodies are rotationally symmetrical, the bristles may be inclined to a small extent in the rotational direction in order to discourage undesired rotation of the bodies. For example, alternate bristles or groups of bristles around the bodies may be inclined in alternate directions in a cross-ply structure to stabilise the bodies against such rotation.



The bristles of each of the bodies are mounted in groups upon a plurality of bristle-carrying members each guided for movement towards and away from the said body. These bristle-carrying members may be spaced apart at intervals over the surface of the body but preferably they combine to cover the whole of the relevant surface of the body and therefore lie closely together at one limit of their guided movement. By way of example, in the case of generally cylindrical bodies having outwardly-directed bristles, the bristle-carrying members may each form one angular segment of the cylindrical surface of the body. Preferably such segments are all of equal angular size, for example 4, 6 or 8 segments each covering, respectively, 90 degrees, 60 degrees or 45 degrees of the cylindrical surface of the body.

The bristle-carrying members are guided so that they may move towards and away from the body upon which they are mounted. Preferably that movement is generally radial with respect to the axis of a generally cylindrical body. To that general end, the axially opposite ends of each bristle-carrying member may be designed to engage generally radial slots or guide channels in the ends of the body. As an alternative, the bristle-carrying members may be mounted upon pins extending through radial apertures or bores in the body, or may themselves slide upon radial pins upon the body.

The movement of the bristle-carrying members towards and/or away from the associated bodies is effected by a fluid pressure means. It is preferred that the latter means be hydraulically, or more preferably pneumatically, operated. By way of example, when the bristle-carrying members each form an angular segment of the body, a membrane, for example a generally cylindrical tubular bag-shaped membrane, may be located along the axis of the body in contact with the radially inner faces of the members. When the membrane is caused to expand outwardly, either by stretching or by unfolding, upon the introduction of, say, compressed air into its interior, the





bristle-carrying members are thereby urged outwardly. The latter members may subsequently disengage from the surface being traversed either simply in response to the absence of radially outward pressure or, more positively, under the action of one or more return springs when the fluid pressure is removed.

In one alternative form of the surface-traversing vehicle according to the present invention, the bristle-carrying members are each supported upon a plurality of inwardly-directed pistons, each arranged to slide, in response to fluid pressure on their inner ends, outwardly within radial, fluid-tight bores within the associated body. The return movement of the bristle-carrying members may, for example, be in response to evacuation of the bores and/or by the action of one or more springs and/or by the resilient action of the bristles themselves.

In yet another form of the vehicle of the present invention, in particular for use in restricted spaces such as within narrow-bore pipes, the bristles may be mounted directly upon pistons, that is, the bristle-carrying members are then themselves in the form of pistons. Typically, such bristle-carrying pistons are moved by means of a membrane, preferably a generally tubular membrane such as in the form of a thin-walled bag.

Whatever the form of the fluid pressure means by which the movement of the bristle-carrying members is effected, it is advantageous to provide also a resilient means tending to resist that movement of the bristle-carrying members. In this way, by varying the pressure of the fluid pressure means, the bristle-carrying members may be set in a selected position intermediate to their fully-retracted and their fully-extended positions. This enables the bristles to be inclined to a greater or lesser extent to take account of variations in the surface being traversed by the vehicle. By way of example, if the frictional value of the surface changes in response to



variations in the surface roughness or as a result of the presence of a lubricant on the surface, the inclination of the bristles may be modified to maintain the desired level of grip of the body upon the surface. Similarly, when the vehicle is being used to traverse the interior surface of a hollow conduit, for example of a pipe, the amount by which the bristle-carrying bodies are extended may be modified in this way to compensate for variations in the internal cross-sectional dimensions of the conduit.

Such a resilient means to resist the movement of the bristle-carrying members may take various forms, including for example that of one or more springs, e.g. coil springs. In one form, the resilient means comprises one or more pieces of a resilient polymeric material, for example an annular piece surrounding an end of the bristle-carrying bodies or one such piece at each end thereof. The polymeric material may for example be of a resilient polyurethane or a natural or synthetic rubber.

When the surface-traversing vehicle according to the present invention includes bristle-carrying members whose degree of extension can be varied as described above, it is advantageous and preferred to provide one or more sensors to monitor the characteristics of the surface, for example pipe diameter and/or surface roughness, ahead of the vehicle, so that the fluid pressure within each body, and thereby the degree of extension of the bristles, may be modified to take account of any variations in the surface characteristics as the vehicle encounters such variations. The fluid pressure may be modified by the person operating the vehicle or, advantageously, using some form of automatic "intelligent" controller.

The resilient bristles may be of any material having the selected resiliency and may be chosen to reflect the circumstances in which the vehicle is to operate including, among other factors, the load to be supported and/or towed by



the vehicle. Thus they may be natural bristles or they may be of a synthetic polymeric material, for example, or of a metal. The selected material preferably has a relatively high stiffness and a good elasticity. It is particularly preferred to use metal bristles, for example of steel, in view of the quick elastic response, and the usually better surface grip, of such metal bristles. Because, by virtue of the present invention, any required reversal of the direction of inclination of the bristles is greatly aided by the retraction of the bristles, bristles of higher stiffness may be used than would be possible if they had to be re-directed without retraction.

The vehicle moves over the surface in response to the movement of the bodies towards and away from each other. This relative movement of the bodies may be achieved by any desired means, for example by electrical power provided by an on-board source such as a rechargeable battery or by a remote source via an electrical line. However it is particularly preferred to effect relative movement of the bodies by fluid pressure, in particular by linking the bodies by a hydraulic or more preferably pneumatic cylinder.

Additional support for the bodies may be provided in the form of one or more wheels, whereby the load borne by the bristles is reduced. Such wheels may be located upon the bodies themselves or upon the links between them, for example.

In one advantageous form of the invention, wheels may be mounted directly upon one or more of the bristle-carrying members. In this way, the distance, or the minimum distance, of the bristle-carrying members from the surface under treatment may be set at an advantageous predetermined value, for example a value at which the inclination of the bristles relative to the surface is optimised.



While the surface-traversing vehicle according to the invention may comprise just two of the bristle-supported bodies, it may prove advantageous to provide three or more such bodies. For example, reversal of the direction of operation of the vehicle may be assisted by the provision of a third body and/or the movement of the vehicle overall may be rendered more smooth in this way. In one arrangement, the bodies may be coupled together in pairs, with the two bodies in each pair being coupled at a fixed distance apart, thereby increasing the effective length of each body.

Particularly when the vehicle comprises at least three of the bristle-supported bodies, it is desirable that the required relative movement of the bodies be effected automatically, for example by means of a suitable controller, which may be located either upon the vehicle or at a remote location, to which latter the vehicle may be linked by a direct line or by radio.

When the vehicle is designed to be operated pneumatically, an air line may be provided from a remote source of compressed air to the pneumatic cylinders. That line may be combined with an electrical line, in the form of an umbilical linking a remote control position to the vehicle. The umbilical may in turn be dragged behind the vehicle by means of a similar towing vehicle specifically provided for that purpose. As the vehicle proper moves further from the control position, supplementary such umbilical tugs may be added. Sensors in the line may monitor tension in the umbilical and in turn prompt an umbilical tug to respond by accelerating or decelerating briefly.

The invention will now be further described with reference to the accompanying drawings, which illustrate, by way of example only, three alternative preferred forms of the bristle-supported bodies of the surface-traversing vehicle according to the present invention and wherein:-





Fig. 1 is a transverse sectional view of the first form of bristle-supported body, with the bristles retracted;

Fig. 2 is an elevation from one end of the body of Fig. 1, with the bristles extended;

Fig. 3 is a transverse sectional view of the second form of bristle-supported body, with the bristles extended;

Fig. 4 is a longitudinal sectional view of one end of a variant form of the body of Fig. 3, with the bristle-carrying bodies extended.

Fig. 5 is a transverse sectional view of the third form of bristle-supported body, with the bristles extended; and

Fig. 6 is a view corresponding to that of Fig. 5, with the bristles retracted.

The body illustrated in Figs. 1 and 2 is of cylindrical form and is constructed from six bristle-carrying members 10, each forming one sector of the cross-section of the cylinder. The members 10 are shown as solid but may be of a more open construction in order to limit their weight. The members 10 are mounted together between disc-shaped end-plates 11 and each member engages a guide slot 12 at each of its ends, which guide slots permit the members 10 to move by a limited amount radially outwardly relative to the axis of the body. Each of the members 10 carries a large number of bristles 13 distributed throughout the length of its outer curved surface.

Located within a central bore 14 and extending throughout the length of that bore is a generally cylindrical, tubular bag-shaped membrane 15, made of a stretchable rubber material. The membrane 15 may be expanded by the introduction of air under pressure into the interior of the tubular membrane and, in expanding, it drives the bristle-carrying members 10



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outwardly, their movement being constrained to a radial path by the guide slots 12. In one form of the invention, the membrane 15 is encircled by a strong restraining sheath, for example of metal foil (not shown), to prevent the membrane entering the gaps which are formed between the members 10 as they move outwardly.

Thus an increase of air pressure within the membrane 15 causes the bristles to move into engagement with the inner wall of a conduit or the like (not shown) within which the vehicle is located and thereby to grip that wall and allow the vehicle to progress along the conduit in the manner described above. Spring means (not shown) may be provided to assist the inward return of the members 10, and thereby retraction of the bristles 13, on removal of the air pressure within the membrane 15. Retraction of the bristles in this way allows the bristle-supported body to be moved axially to redirect the inclination of the bristles.

The form of the bristle-supported body illustrated in Fig. 3 comprises a tubular aluminium cylinder 20 pierced throughout its length by a number of air-tight bores 21. The bores 21 are distributed in staggered pairs along the length of the cylinder. Within each bore 21, a piston-type pin 22 is slidable. Each of four aligned series of pins 22 supports an elongated bristle-carrying member 23, of arcuate cross-section. The members 23 engage each other to combine to form a cylindrical outer face to the body when they are slid radially inwardly to the maximum extent.

Each pin 22 carries an integral disc-shaped plate 24 at its inner end. The staggering of the bores 21 as illustrated allows the pins 22 to move towards their radially most inward positions without mutual interference.

Because the bores 21 are air tight, an increase of air pressure within the cylinder 20, acting upon the plates 24, causes the



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pins 21 to move radially outwardly and in turn to move the members 23, and bristles 25 carried by them, to their outermost positions as shown. In this position, the bristles may engage the inside face of a generally tubular conduit. When it is desired to retract the bristles out of engagement with the surface which is being traversed by the vehicle, the pins 22 are withdrawn radially inwardly by a reduction of the air pressure within the cylinder 20. The retraction of the members 23 in this way may, if desired, be aided by springs provided to act upon the pins 22 and/or by the natural resilience of the bristles 25.

The bristle-supported body of which one end is illustrated in Fig. 4 is closely similar to that of Fig. 3 and like numerals are used to identify like parts. However at each end of the body, a resilient annular "spring" 28 of polyurethane encircles the bristle-carrying members 23 between the outer surface of those members and a flange 26 projecting from the end-plate 27.

The body of Fig. 4 is illustrated in the condition in which the bristles 25 are extended to a maximum extent and in which therefore the spring 28 is fully compressed. However if the air pressure within the cylinder 20 is set at a lower level, then the resilience of the spring 28 urges the members 23 radially inwardly until a balance is reached between the air pressure within the cylinder 20 acting upon the pressure plates 24 and the inwardly-directed pressure of the spring. Thus the degree to which the members 23 and bristles 25 are extended radially outwardly can be set at any time by varying the air pressure in the cylinder 20. In this way, the bristles can be inclined against the inner face of a conduit in which the bristle-supported body is located, to an angle of inclination appropriate to the internal diameter of the conduit and to the frictional characteristics of the inner surfaces of the conduit. That angle of inclination can subsequently be varied readily by increasing or reducing the air pressure to the necessary extent.



Referring now finally to Figs. 5 and 6, the bristle-supported body 30 there illustrated is of particular value, but not exclusively, for use in a tubular conduit of a relatively small diameter, for example of the order of 5 to 15 cm. Piston-shaped ferrules 31, each of which supports a number of bristles 32, extend radially through the body 30 and are free to move by a short radial distance relative to the body. In the illustrated form of the invention, the ferrules are mounted in symmetrical groups of three, alternate groups being staggered angularly along the length of the body 30.

The inner ends of the ferrules 31 are in the form of flat plates 33 and, within the body 30 and designed to apply an outward radial force upon the plates 33, is an air bag 34. As shown in Fig. 5, when the air bag 34 is inflated, the bristles are driven outwardly to enable them to engage the inner surface of a cylindrical conduit (not shown) in which the body 30 is disposed.

When the air bag 34 is subsequently evacuated and thereby collapsed inwardly as shown in Fig. 6, the ferrules 31 return inwardly into the body 30 by virtue of the resilience of the bristles 32 and the bristles are thereby retracted, to enable the surface-traversing vehicle to be moved axially, for example to reverse the direction of inclination of the bristles relative to the surface being traversed.





CLAIMS

1. A surface-traversing vehicle comprising two bodies interconnected by means to move the bodies towards and away from each other, each said body being supported upon a multiplicity of resilient bristles (13; 25; 32) extending from it, characterised in that the bristles of each said body are mounted in groups upon a plurality of bristle-carrying members (10; 23; 31) each guided for movement towards and away from said body, and characterised further by fluid pressure means (15; 22; 34) to effect said guided movement of said bristle-carrying members in at least one of said directions.
2. A surface-traversing vehicle according to Claim 1, characterised in that the interconnected bodies are generally flat or are rotationally symmetrical.
3. A surface-traversing vehicle according to Claim 2, characterised in that the interconnected bodies are generally cylindrical and that the bristles extend generally radially outwardly or inwardly of the body.
4. A surface-traversing vehicle according to Claim 3, characterised in that alternate bristles or groups of bristles around the bodies are inclined to a small extent in alternate directions in the rotational direction of the bodies.
5. A surface-traversing vehicle according to any of the preceding claims, characterised in that the bristle-carrying members (10; 23) combine to cover the whole of the relevant surface of the body at one limit of their guided movement.
6. A surface-traversing vehicle according to Claim 5, characterised in that the bristle-carrying members (10; 23) each form one angular segment of the surface of a generally cylindrical body.



7. A surface-traversing vehicle according to any of the preceding claims, characterised in that the movement of the bristle-carrying members is guided by slots (12), guide channels, apertures or bores (21) in the body or by radial pins upon the body.

8. A surface-traversing vehicle according to any of the preceding claims, characterised in that the fluid pressure means comprises a membrane (15; 34) in contact with the inner faces of the bristle-carrying members (10; 31).

9. A surface-traversing vehicle according to any of Claims 1 to 7, characterised in that the fluid pressure means comprises a plurality of pistons (22) arranged to slide in fluid-tight bores (21) within the associated body.

10. A surface-traversing vehicle according to Claim 9, characterised in that the bristle-carrying members are themselves in the form of said pistons.

11. A surface-traversing vehicle according to any of the preceding claims, characterised in that it comprises also a resilient means (28) tending to resist the guided movement of the bristle-carrying members.

12. A surface-traversing vehicle according to Claim 11, characterised in that said resilient means comprises one or more springs.

13. A surface-traversing vehicle according to Claim 11 or Claim 12, characterised in that it also comprises one or more sensors to monitor the characteristics of the surface ahead of the vehicle.

14. A surface-traversing vehicle according to any of the preceding claims, characterised in that said resilient bristles



(13; 25; 32) are natural bristles or of a synthetic polymeric material or of a metal.

15. A surface-traversing vehicle according to Claim 14, characterised in that said resilient bristles (13; 25; 32) are of steel.

16. A surface-traversing vehicle according to any of the preceding claims, characterised in that the means to move the bodies towards and away from each other comprises electrical power.

17. A surface-traversing vehicle according to any of Claims 1 to 15, characterised in that the means to move the bodies towards and away from each other comprises fluid pressure.

18. A surface-traversing vehicle according to Claim 17, characterised in that the bodies are linked by a hydraulic or pneumatic cylinder.

19. A surface-traversing vehicle according to any of the preceding claims, characterised in that the bodies are further supported by one or more wheels, located upon said bodies or upon the links between them or upon one or more of the bristle-carrying members.

20. A surface-traversing vehicle according to any of the preceding claims, characterised in that it comprises three or more said bodies.

21. A surface-traversing vehicle according to Claim 20, characterised in that the bodies are coupled together in pairs, the two bodies in each pair being at a fixed distance apart.

22. A surface-traversing vehicle according to any of the preceding claims, characterised in that it comprises a control



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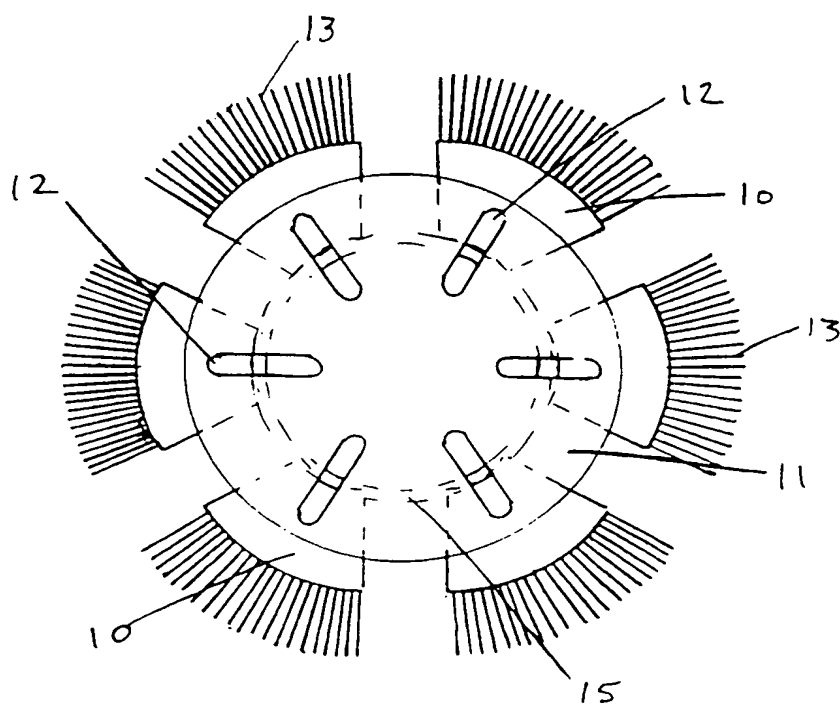
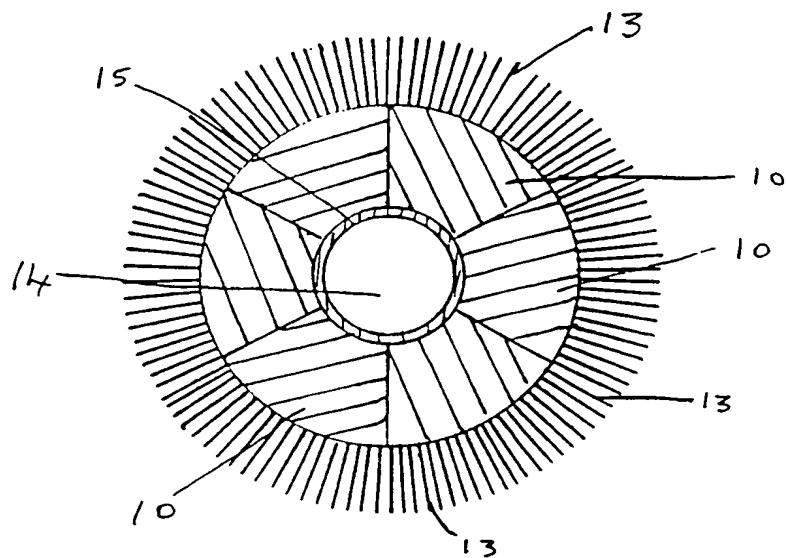
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means to effect automatically the relative movement of the bodies.

23. A surface-traversing vehicle according to any of the preceding claims, characterised in that it is operated from a remote position via an umbilical line towed by a similar towing vehicle.









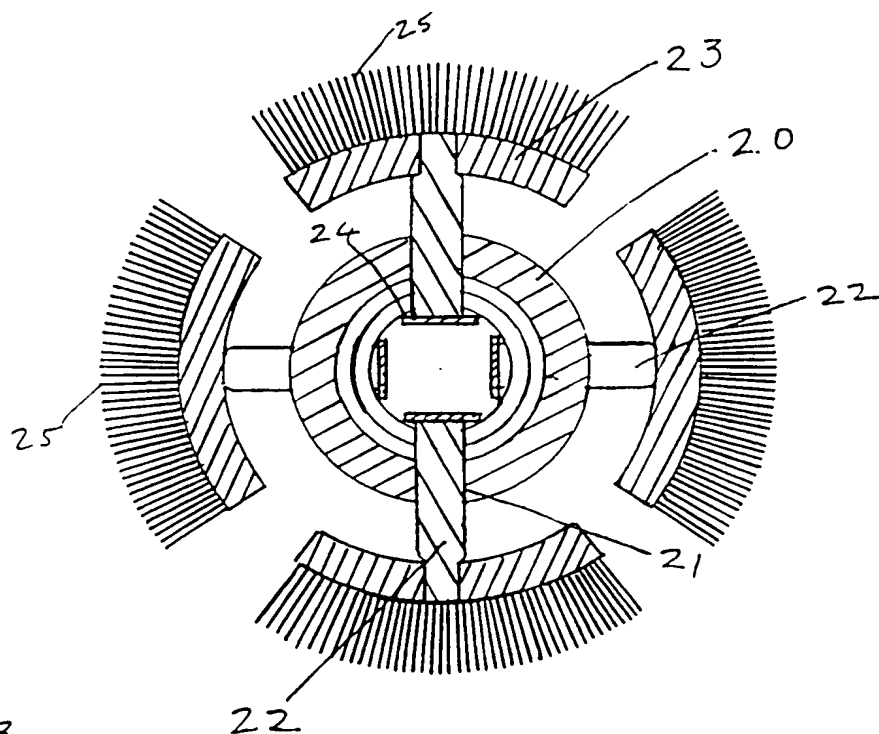


FIG. 3.

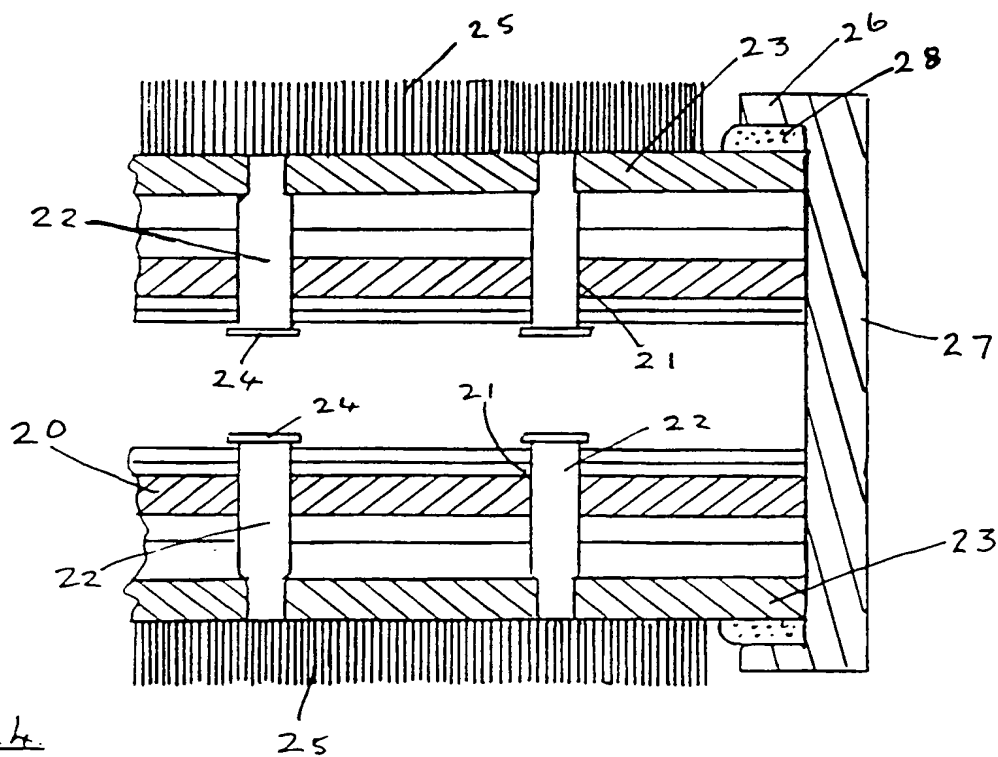


FIG. 4.



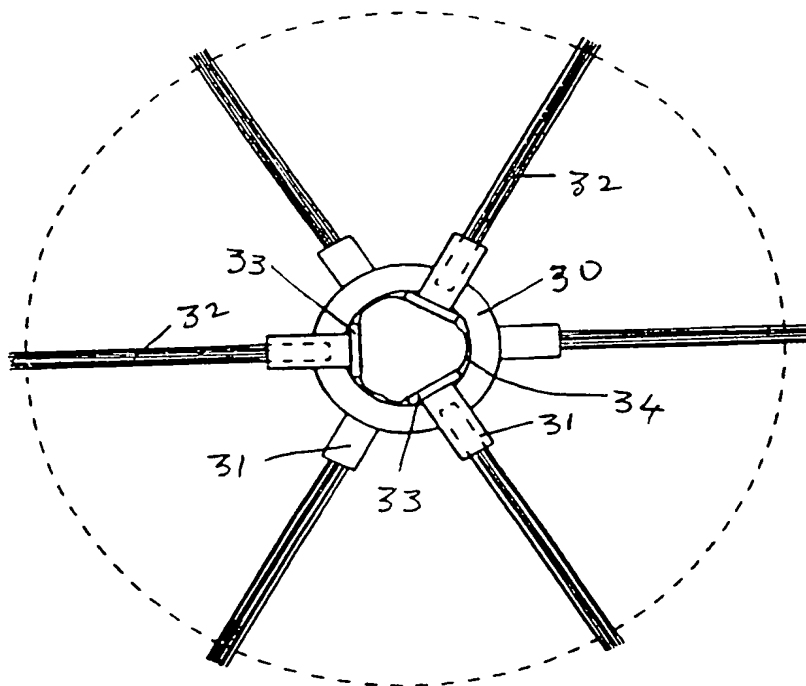


FIG. 5.

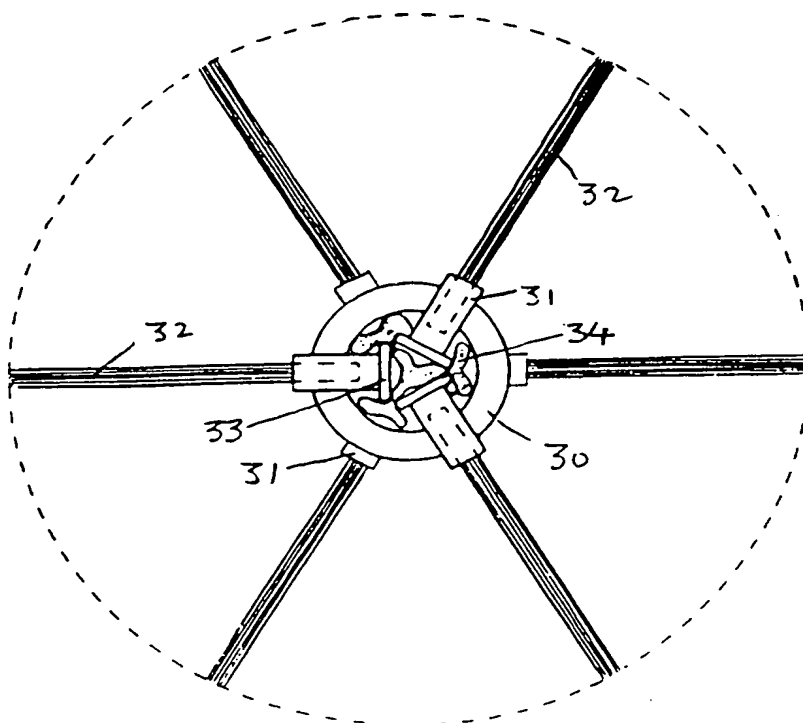


FIG. 6.



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/00153

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 F16L55/28

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	WO 98 06927 A (ASTEC DEV LTD ;SIMPSON NEIL ANDREW ABERCROMBI (GB)) 19 February 1998 see page 14, line 19 - page 16, line 25; figures 5-7	1-3, 16, 17
A	GB 2 305 407 A (UNIV DURHAM) 9 April 1997 cited in the application see page 3, line 21 - page 7, line 14; figures	1-5, 14, 15
A	US 5 121 694 A (ZOLLINGER WILLIAM T) 16 June 1992	
A	US 5 625 917 A (HAWKINS RONALD E) 6 May 1997	

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Date of the actual completion of the international search

16 April 1999

Date of mailing of the international search report

03/05/1999

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Information on patent family members

International Application No

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